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TRANSMISSIBILITY OF IMMUNITY FROM MOTHER TO OFFSPRING IN HOG CHOLERA

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In earlier publications different investigators have noted that pigs from immune mothers possess a certain amount of immunity to hog cholera. The extent of this immunity as well as its duration varies somewhat in the different reports. While several reports are noted from observations made in the field and not under experimental conditions, the following review of the literature gives a brief summary of the experimental data which is available on the subject.

Peters¹ found that hogs recovering from an attack of hog cholera were immune, as were also their litters. Pigs farrowed from sows which were vaccinated with the double treatment 3 weeks previous to farrowing, were not immune after 5 months. Jacob² reports that sows treated with antiserum did not become infected with hog cholera while their litters died with the disease. He does not state, however, whether or not the pigs were suckling when they became infected. The report by Reynolds³ states that litters farrowed from immune sows are highly immune to the disease. He reports further that if these pigs are given small amounts of virus they will withstand the injection and become actively immune, otherwise the immunity is eventually lost after weaning. The sows used in his work were immune from passing through an outbreak of the disease and not from vaccination.

In the experimental work conducted thus far by different investigators, the greater part of the work has not been conducted under control conditions, as most of the sows used in the experiments were immune from having passed through an outbreak of the disease, and but few were rendered immune by the Dorset-Niles method of treatment.

Because of the importance of this question and the small amount of experimental data available, the following experiments were conducted with sows immune from the Dorset-Niles treatment, in order that further information might be secured. The fact that only swine are susceptible to hog cholera besets the study of this transmitted immunity

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¹ Neb. Sta. Report, 1909, p. 111.

² Tenn. Sta. Report, 1909, p. 112.

³ Am. Vet. Rev., 1910, 38, p. 236.

with more or less difficulty. In order to study the subject thoroughly one should be able to secure milk from the mother as well as blood samples from both mother and offspring and test these for immune bodies. In the case of hogs, milk can rarely be secured, and then only with difficulty; further, there is as yet no laboratory test which can be applied for this disease.

All sows used in these experiments were secured from the surrounding country. These sows had never been treated with antihog cholera serum, and so far as known were not immune from exposure or passing through an outbreak of the disease. The sows varied in weight from 200-350 lbs., and whenever possible, sows were secured which had previously farrowed 1 or 2 litters. As soon as these sows were delivered to the experimental pens they were given the Dorset-Niles antihog cholera serum with virus. The quantity of serum and virus used being that recommended in the regular treatment according to the weight of the hog. In a few instances the serum alone without the virus was given, as will be noted under the different experiments. Practically all of the sows were pregnant when vaccinated. After treatment the sows were placed in sheds 8 by 13 feet with concrete floor. They remained in these sheds until after the litters were weaned.

Exper 1.—Two classes of sows were included in this experiment. Those receiving antiserum without virus and those receiving both antiserum and virus but showing only a passive immunity after treatment. As shown in the following table some of the litters were exposed to virus pigs when 4 days old. All pigs which survived were given an injection of virus after weaning to test the extent of their immunity. Data was secured from 5 litters.

Sow No.	Number of Pigs in Litter	First Treatment	Second Treatment	Number of Pigs Showing Cholera Lesions on Necropsy	Number of Pigs Without Cholera Lesions on Necropsy	Number of Pigs Surviving
1	3	Exposed to virus pigs when 4 days old	Sow sickened. Given 180 cc of antihog cholera serum	3	0	0
3	4	Exposed to virus pigs when 4 days old	Surviving pigs given 0.5 cc of virus 6 weeks after weaning	0	1	3
8	5	0	5	0
10	All dead; sow died	Exposed to virus pigs when 4 days old	Sow died of cholera before pigs were weaned	2	2	0
16	4	No treatment	Sow and pigs died 2 days after farrowing; sow with cholera	0	5	0

The results of the foregoing experiment would indicate that the pigs were immune as long as the mother was immune and the pigs were suckling. As soon as the sow sickened practically all of the pigs contracted the disease and died. All of the surviving pigs of sow No. 3 were still immune 6 weeks after weaning and withstood an injection of virus.

Exper. 2.—Only sows, which had received both antihog cholera serum and virus and were proven immune, were used in this experiment. The litters as well as the sows were exposed to hog cholera by placing in the pen virus pigs with well marked cases of the disease. The virus pigs were sometimes allowed to remain in the pens from 12-24 hours after death.

Sow No.	Number of Pigs in Litter	First Treatment	Second Treatment	Number of Pigs Showing Cholera Lesions on Necropsy	Number of Pigs Without Cholera Lesions on Necropsy	Number of Pigs Surviving
2	6	Exposed to virus pig when 2 days old	Exposed to virus pig after weaning	0	3	3
4	4	Exposed to virus pig when 1 week old	Exposed to virus pig after weaning	0	1	3
6	8	Exposed to virus pig when 1 day old	Exposed to virus pig after weaning	0	1	7
9	6	Exposed to virus pig when 1 day old	Exposed to virus pig after weaning	1	1	4
14	5	Exposed to virus pig when 1 day old	Exposed to virus pig after weaning	1	1	3

Of the different pigs which died in this experiment, only 2 showed lesions of hog cholera. All of the surviving pigs were exposed to virus pigs twice, once while suckling and once after weaning. Three of the pigs were given an injection of 0.25 c c of virus over 2 months after weaning and still survived. From the large percentage which survived it is evident that these pigs were highly immune.

Exper. 3.—The sows in this experiment had all received antihog cholera serum and virus and were proven actively immune after treatment. The experiment differs from the previous experiments, in that the pigs received

Sow No.	Number of Pigs in Litter	First Treatment	Second Treatment	Number of Pigs Showing Cholera Lesions on Necropsy	Number of Pigs Without Cholera Lesions on Necropsy	Number of Pigs Surviving
5	5	Teats of sow smeared with virus	Exposed to virus pig after weaning	0	2	3
12	3	Teats of sow smeared with virus	Exposed to virus pig after weaning	0	0	3
25	9	Teats of sow smeared with virus	Exposed to virus pig after weaning	1	1	7
29	7	Teats of sow smeared with virus	Exposed to virus pig after weaning	0	1	6
30	4	Teats of sow smeared with virus	Exposed to virus pig after weaning	1	0	3

virus by way of the stomach and digestive tract. In each case 2 days after the pigs were farrowed the teats of the mother were smeared with virulent hog cholera virus. In this way each pig received some of the virus while suckling. All surviving pigs were exposed to virus pigs to determine whether or not they were immune after weaning.

Of the entire number of pigs which died in this experiment only 2 showed cholera lesions. A large percentage of each litter survived the treatment. This would indicate that these pigs were highly immune to hog cholera infection by way of the digestive tract so long as they were suckling.

Exper. 4.—As in the previous experiment, the sows in this experiment received both antiserum and virus and were immune to the disease. The experiment differs from the previous experiments in that each pig was given an injection of virus while suckling as noted in the following table. All surviving pigs were given another injection of virus after weaning.

Sow No.	Number of Pigs in Litter	First Treatment	Second Treatment	Number of Pigs Showing Cholera Lesions on Necropsy	Number of Pigs Without Cholera Lesions on Necropsy	Number of Pigs Surviving
7	9	Given 0.5 c c of virus when 1 week old	Given 1 c c of virus 2 weeks after weaning	2	6	1
11	6	Given 0.5 c c of virus when 4 weeks old	Given 1 c c of virus 5 days after weaning	0	2	4
15	8	Given 0.5 c c of virus when 1 week old	Given 1 c c of virus 2 weeks after weaning	1	1	6
19	7	Given 0.5 c c of virus when 2 weeks old	Given 1 c c of virus 2 weeks after weaning	0	0	7
26	7	Given 0.5 c c of virus when 1 week old	Given 1 c c of virus 2 weeks after weaning	0	1	6

A large percentage of the pigs withstood the injection of virus both before and after weaning. While the death rate was rather high, only 3 pigs showed hog cholera lesions on necropsy. The pigs were as highly immune to the injections of virus as to any of the methods of exposure in the previous experiments.

Exper. 5.—All of the sows were actively immune to hog cholera from treatment with antiserum and virus. This experiment differs from all of the preceding experiments in that the litters were not exposed to hog cholera until after weaning. Each pig was given an injection of virus from 2 days to 2 weeks after weaning. This was to determine whether or not their immunity was lost soon after weaning.

Sow No.	Number of Pigs in Litter	Treatment	Number of Pigs Showing Cholera Lesions on Necropsy	Number of Pigs Without Cholera Lesions on Necropsy	Number of Pigs Surviving
13	1	Given 1 c c of virus 2 days after weaning	1	0	0
17	5	Given 0.5 c c of virus 2 weeks after weaning	0	0	5
20	7	Given 0.5 c c of virus 4 days after weaning	0	1	6
21	5	Given 0.5 c c of virus 1 week after weaning	2	0	3
22	5	Given 0.5 c c of virus 2 days after weaning	0	0	5
23	9	Given 0.5 c c of virus 4 days after weaning	0	0	9

In nearly every case these pigs survived the injection of virus when given from 2 days to 2 weeks after weaning. These results would indicate that the litters were as highly immune shortly after weaning as before weaning.

Exper. 6.—The data in this experiment were from the second litter farrowed since the mother was vaccinated. In this way it was hoped to determine the degree of immunity of the second litter as compared to the first litter from the same sow. The sows were all immune to hog cholera having received both antiserum and virus. In practically all cases the sows were vaccinated at least 6 months before these litters were farrowed. The litters were not exposed to hog cholera until after weaning, when they were given an injection of virus.

Sow No.	Number of Pigs in Litter	Treatment	Number of Pigs Showing Cholera Lesions on Necropsy	Number of Pigs Without Cholera Lesions on Necropsy	Number of Pigs Surviving
3	6	Given 0.5 c c of virus 2 days after weaning	0	0	6
5	9	Given 0.5 c c of virus 4 days after weaning	0	2	7
17	5	Given 0.5 c c of virus 2 weeks after weaning	0	0	5
18	8	Given 0.5 c c of virus 1 week after weaning	0	0	8
21	4	Given 0.5 c c of virus 2 days after weaning	0	2	2

These results would indicate that second litters are possibly more highly immune than first litters, as the death rate was low and none of the pigs showed cholera lesions. It is evident that second litters are immune to hog cholera so long as they are suckling an immune mother.

SUMMARY

The results of these experiments would indicate that sows immunized against hog cholera by the Dorset-Niles method transmit this immunity to their offspring. In nearly every case the pigs retained

their immunity as long as they were suckling and the sow was immune. When the mother contracted the disease the pigs did not usually survive more than a few days, and in some instances cholera lesions were found on necropsy.

There seemed to be but little difference in susceptibility of these suckling pigs to different methods of exposure.

The duration of immunity in the different pigs, after weaning, was only tested to a limited extent. From the data available, it is evident that different pigs vary, but in most cases the immunity lasted a few weeks after weaning.

A number of pigs died in the different experiments without showing cholera lesions. Death in these cases was probably due to indigestion, worms, etc., and not to hog cholera.

Second litters were as highly immune as the first litters in all cases, and in some instances even more highly immune while suckling.

The method whereby the antibodies are transmitted from mother to offspring in hog cholera is more or less an open question. The fact that the suckling litters sicken as soon as the mother becomes infected, also, that immunity is gradually lost after weaning, would indicate that the antibodies are transmitted through the milk during the entire suckling period.

Data were secured from 31 litters, covering a total of 179 pigs. Of this number 125, or 69.8%, survived all treatment; 39, or 21.7%, succumbed during the course of the experiments, but did not show cholera lesions on necropsy and 15 pigs, or 8.3%, died showing cholera lesions. From these results it might be considered that 91.7% of the pigs were immune to hog cholera. It is entirely possible, however, that some of the pigs which died without cholera lesions were affected more or less with the disease, and that the percentage of pigs showing immunity would be less than 91.7%.